

BIDDING REQUIREMENTS, CONTRACT FORMS AND CONTRACT CONDITIONS

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BIDDING SCHEDULE

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
0001	Mobilization and Demobilization	1	LS		\$_____
0002	Stripping and Excavation	1	LS		\$_____
0003	Embankment	1	LS		\$_____
0004	Riprap, C-Stone	450	TN	\$_____	\$_____
0005	Bedding Material	110	TN	\$_____	\$_____
0006	Reinforced Concrete Pipe	1	LS		
0007	Crushed Stone Surfacing	585	TN	\$_____	\$_____
0008	Care of Water	1	LS		\$_____
0009	Lower Access Road Concrete Slab	1	LS		\$_____

TOTAL \$_____

ABBREVIATIONS

LS Lump Sum

TN Ton

EA Each

BIDDING SCHEDULE NOTES

1. All quantities shown on the BIDDING SCHEDULE are estimated quantities except when the unit is shown as lump sum "LS".
2. When bids are solicited on a unit price basis, bidders shall insert in the spaces provided therefore in the SCHEDULE both the "unit price" and the "estimated amount" resulting from applying the said unit price to the estimated quantity shown. In event the bidder quotes only a total price ("estimated amount") in its bid and fails to quote the unit price, the Government will determine such unit price by dividing the total price quoted by the quantity of the item set out in the SCHEDULE. The bidder agrees that the unit price so determined shall be used for the purpose of bid evaluation, award and all payments to the Contractor including final payment.
3. All extensions of the unit prices shown will be subject to verification by the Government. In case of variation between the unit price and the extension, the unit price will be considered to be the bid and the extension will be corrected accordingly.
4. If a modification to a bid based on unit prices is submitted, which provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price in the bid schedule must be stated. If it is not stated, the bidder agrees that the lump sum adjustment shall be applied on a pro rata basis to every unit price in the bid schedule.
5. Bidders are required to bid on all items listed on the Bidding Schedule in addition to inserting a total quoted bid in the appropriate space provided. Failure to do so will be considered good cause to disqualify the bid.
6. Bidders are encouraged to pay particular attention to the requirements on lab "validation" in Section 01440 of the contract specifications.

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PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

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SECTION 01025 - MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 MOBILIZATION AND DEMOBILIZATION. Mobilization and demobilization will not be measured for payment. Payment will be made for costs associated with mobilization and demobilization, as defined in SECTION 00700 CONTRACT CLAUSE entitled, PAYMENT FOR MOBILIZATION AND DEMOBILIZATION.

1.2 STRIPPING AND EXCAVATION. Payment for stripping and excavation will be made at the contract lump sum price for "Stripping and Excavation", which price and payment shall constitute full compensation for the costs of all labor, equipment, and materials required to perform the work as specified in SECTION 02110 - STRIPPING AND EXCAVATION, and as shown on the drawings.

1.3 EMBANKMENT. Embankment will be will be made at the contract lump sum price for "Embankment", which price and payment shall constitute full compensation for the costs of all labor, equipment, and materials required to perform the work as specified in SECTION 02222 - EMBANKMENT, and as shown on the drawings.

1.4 STONE PROTECTION.

1.4.1 Measurement. The C-stone, bedding material and crushed stone surfacing will be measured for payment by the ton (2,000 pounds) with final quantities rounded to the nearest whole ton. Stone weight to be paid for will be determined from certified weight tickets which shall be furnished by the Contractor without additional cost to the Government. A certified weight ticket shall be defined as each truck being weighed empty, and again when loaded and the ticket, identified by the Contractor's name and the contract number, signed by the approved quarry representative with the statement "certified correct". This procedure shall be followed for each load hauled. The Contractor shall initial each ticket to verify the accuracy and completeness of each ticket before submitting it to the Government. Certification stating the scales were tested and approved by the local authority shall be furnished by the Contractor.

1.4.2 Payment. Payment for stone protection will be made at the contract unit price per ton for "Riprap - C Stone", "Bedding Material" and "Crushed Stone Surfacing", which price and payment shall constitute full compensation for all costs of furnishing, transporting and placing the stone materials required and for maintaining the work until acceptance as specified herein, and as shown on the drawings.

1.5 REINFORCED CONCRETE PIPE.

1.5.1 Payment. Payment for reinforced concrete pipe will be made at the applicable contract lump sum price for "Reinforced Concrete Pipe", which prices and payments shall constitute full compensation for furnishing and installing the reinforced concrete pipe, including all accessories and any necessary earthwork required, as specified in SECTIONS 02200 - EARTHWORK,

STORM SEWER and 02611 - REINFORCED CONCRETE PIPE FOR CULVERTS, and as shown on the drawings.

1.6 CARE OF WATER. Payment for care of water will be made at the applicable contract lump sum price for "Care Of Water", which prices and payments shall constitute full compensation for furnishing all plant, labor, equipment, and material necessary for performing all work as specified in SECTION 02140 - CARE OF WATER, and as shown on the drawings.

1.7 LOWER ACCESS ROAD CONCRETE SLAB. Payment for the lower access road concrete slab will be made at the applicable contract lump sum price for "Lower Access Road Concrete Slab", which prices and payments shall constitute full compensation for furnishing all plant, labor, equipment, and material necessary for performing all work as specified in SECTION 03300 - CONCRETE, and as shown on the drawings.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-END OF SECTION 01025-

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SECTION 02110
STRIPPING AND EXCAVATION

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SECTION 02110 - STRIPPING AND EXCAVATION

PART 1 GENERAL

1.1 SCOPE. This section covers all operations in connection with stripping and excavation, as specified herein and shown on the drawings. Excavation and fill shall be performed within the limit lines and grades shown on the drawings and defined herein, however the Government reserves the right to modify/establish such limits and grades as may be determined necessary by the Contracting Officer.

1.1.1 Related Work Specified Elsewhere.

1.1.2 Embankment. Embankment and foundation preparation are specified in SECTION 02222 - EMBANKMENT.

1.2 QUALITY CONTROL.

1.2.1 General. The Contractor shall establish and maintain quality control for all operations to assure compliance with contract requirements and maintain records of its quality control for all construction operations, including but not limited to the following:

- (1) Stripping and excavation (lines and grades).
- (2) Grading disposal areas.
- (3) Foundation cleanup.
- (4) Disposition of materials.
- (5) Drainage of borrow areas.

1.2.2 Reporting. A copy of these records and tests, as well as the records of corrective action taken, shall be furnished to the Government daily.

1.3 GENERAL. All operations specified in this section shall be performed in accordance with a plan of operations submitted by the Contractor and approved by the Contracting Officer. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. Submittals shall be in accordance with SECTION 01300 - SUBMITTAL PROCEDURES. Excavation of the materials for use in the construction of the embankment shall be so conducted as to segregate materials of different character in accordance with their suitability for placement in the various parts of the work, or stockpiled prior to such use. The right-of-way and earth materials for constructing the work will be furnished without cost to the Contractor at the locations shown on the drawings. Control of water shall be as specified in SECTION 02140 - CARE OF WATER.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

PART 3.1 STRIPPING

3.1.1 GENERAL. Stripping shall consist of close-growing vegetation consisting of crops, grass, bushes and weeds. The entire surface of the access road shall be stripped a minimum of 3 inches, or as directed. Material obtained from the stripping operations may be spread evenly over areas adjacent to the work location.

3.2 EARTH EXCAVATION.

3.2.1 General. Earth excavation comprises and includes overburden excavation, excavation of material for construction of low water crossings and borrow excavation. Excavation shall consist of the removal of all material to the lines and grades indicated, specified, or directed. Material required for the Contractor's construction of haul roads and facilities may be obtained from excavated materials required to be wasted, and no other source of material from Government-owned lands will be provided.

3.2.2 Slides. In the event a slide occurs in an excavated area, the Contractor shall perform the necessary repair as directed. If the Contracting Officer determines that the slide was due to negligence of the Contractor, no additional payment will be made for the repair. If the Contracting Officer determines that the slide was not due to negligence of the Contractor, the Contracting Officer will order, in writing, that necessary repairs be made and such additional work will be paid for at the applicable contract price for the excavation required.

3.2.3 Over-Excavation. Unauthorized over-excavation shall be at the Contractor's expense; authorized over excavation will be paid for at the applicable contract price for the material excavated. The Contracting Officer will determine which over-excavations are to be backfilled, and such over-excavations shall be backfilled to grade with appropriate materials in accordance with the provisions of SECTION 02222 - EMBANKMENT. Backfill for authorized over-excavation will be paid for at the applicable contract price for the material used. Backfill of unauthorized over-excavation shall be at the Contractor's expense.

3.2.4 Overburden Excavation. Overburden excavation shall comprise and include the removal and disposal of all earth, sand, clay, gravel, boulders and slump blocks (not large enough to be classified as rock), and compacted impervious fill materials specified for removal as can be readily excavated by ordinary earth moving equipment. Overburden excavation shall consist of all material, as defined above, to be excavated for all the permanent work and work incidental thereto, except material specified otherwise herein, shown on the drawings, or determined by the Contracting Officer to fall in other classifications.

3.2.5 Disposition of Materials. Material from the low water crossing excavations shall be placed in the scoured area just north of crossing number two. Material in excess of what will be needed to fill this scour is to be spread evenly over the adjacent area, or as directed by the Contracting Officer.

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SECTION 02140 - CARE OF WATER

PART 1 GENERAL

1.1 SCOPE. The work provided for herein consists of furnishing all plant, labor, material, and equipment and performing all operations required for designing, furnishing, installing, testing, operating, maintaining and removing a system to unwater, dewater, and control surface water in the construction area.

1.2 QUALITY CONTROL.

1.2.1 General. The Contractor shall establish and maintain quality control for the work specified in this section to assure compliance with contract requirements and maintain records of quality control for all construction operations, including but not limited to the following:

(1) Surface Water Removal. Design, submittal of plan, installation, adequacy, operation, maintenance and removal of subsurface and surface water control systems.

1.2.2 Reporting. A copy of these records and tests, as well as the records of corrective action taken, shall be furnished to the Government daily.

1.3 SUBMITTALS. Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01300 SUBMITTAL PROCEDURES:

1.3.1 Statements. Care of Water Plan; GA. Submit complete details of proposed subsurface and surface water removal plan within 15 days following Notice to Proceed.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL. All work shall be performed in the dry (free of water) conditions to construct the reinforced concrete pipe(RCP) culvert drains. The work for the construction of the culvert drain includes, but is not limited to, excavation; placement of pipe bedding material; RCP installation; pipe backfill; and embankment under this contract except as otherwise specified. The care of water shall be accomplished by sequencing the construction, grading the areas around the excavation limits with swales, trenching, damming, storm drain diversion, cofferdams, and other necessary installations to prevent ditch flows, and surface water runoff from flowing into the excavations and pipe installation work areas. Construction of the low water crossings can be done in the wet.

3.2 CARE OF WATER PLAN. Before starting installation of any care of water plan, the Contractor shall prepare and submit to the Contracting Officer a detailed plan, including equipment and materials to be used and the sequence of operation for care of water. The Contractor's plan shall include complete

details of proposed cofferdam dewatering and surface water control, including but not necessarily limited to all cofferdams, flumes, sumps, sump pumps, ditches or other work necessary to keep the work areas drained. The Contractor Officer's review of the proposed plan will not relieve the Contractor of its responsibility to provide a plan adequate to accomplish the desired results.

3.3 MAINTENANCE AND SERVICING. The Contractor shall be responsible for the maintenance, servicing, and repairs of the entire dewatering and surface water control system during the life of the contract. Maintenance, servicing, and repair operations are not cause for relaxation of the specified dewatering or surface water control requirements, and the system shall be designed to provide the specified conditions during maintenance, servicing and repair.

-END OF SECTION 02140-

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SECTION 02200
EARTHWORK, STORM SEWER

PART 1 - GENERAL

1.1 SCOPE. This section covers earthwork and shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; backfilling; pipe embedment; construction of fills and embankments; surfacing and grading; and other appurtenant work required to construct the interceptor sewer.

1.2 GENERAL. This work consists of placement of RCP at the previous entrance to the county road maintenance facility, final location to be determined by the Contracting Officer. Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Contracting Officer. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

1.3 APPLICABLE PUBLICATIONS. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1.3.1 American Society for Testing and Materials (ASTM).

ASTM D 698-91 (R 1998)	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft ³ (600 kN-m/m ³))
ASTM D 4253-93 (R 1996)	Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D 4254-91 (R 1996)	Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

1.3.2 American Water Works Association (AWWA).

AWWA C 200-97	Steel Water Pipe - 6 in. (150 mm) and Larger
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1.3.3 The Society for Protective Coatings (SSPC).

SSPC Paint 16-91	Coal Tar Epoxy-Polyamide Black (or Dark Red) Paint
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1.3.4 Missouri Department of Transportation (MO DOT).

MO DOT Standard Drawings - Latest Edition

PART 2 - PRODUCTS

2.1 MATERIALS.

2.1.1 Inundated Sand Fills. Sand shall be clean, with not more than 25 percent retained on a No. 4 sieve and not more than 7 percent passing a No. 200 sieve, and shall have an effective size between 0.10 and 0.30 mm.

2.1.2 Graded Gravel. Gravel for compacted backfill shall conform to the following gradation:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
1 inch	100
3/4 inch	85 - 100
3/8 inch	50 - 80
No. 4	35 - 60
No. 40	15 - 30
No. 200	5 - 10

The gravel mixture shall contain no clay lumps or organic matter. The fraction passing the No. 4 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.2 TESTS. As stipulated in the quality control section, all tests required for preliminary review of materials shall be made by an acceptable independent testing laboratory at the expense of the Contractor. Two initial gradation tests shall be made for each type of embedment, fill, or backfill material, and one additional gradation test shall be made for each additional 500 tons of each material. Moisture-density (Proctor) tests and relative density tests on the materials, and all in-place field density tests, shall be made at the expense of the Contractor.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION.

3.1.1 Clearing. All clearing shall be performed as necessary for access, stringing of pipeline materials, and construction of the pipeline and appurtenant structures.

3.2 EXCAVATION. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

Except where exterior surfaces are specified to be dampproofed, monolithic concrete manholes and other concrete structures or parts thereof, which do not have footings that extend beyond the outside face of exterior walls, may be placed directly against excavation faces without the use of outer forms, provided that such faces are stable and also provided that a layer of polyethylene film is placed between the earth and the concrete.

3.2.1 Classification of Excavated Materials. No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition, or condition thereof.

3.2.2 Unauthorized Excavation. Except where otherwise

authorized, indicated, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced, by and at the expense of the Contractor, with concrete placed at the same time and monolithic with the concrete above.

3.3 BLASTING PROHIBITION. The Contractor shall not blast with explosives as an excavation method. This prohibition is to prevent damage to nearby residential structures.

3.4 DEWATERING. Dewatering equipment shall be provided to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations 12 inches or more below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavations or trenches to the greatest extent possible without causing damage to adjacent property.

The Contractor shall be responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipe or conduit shall be left clean and free of sediment.

3.5 SHEETING AND SHORING. Except where banks are cut back on a stable slope, excavations for structures and trenches shall be in accordance with the Corps of Engineers safety and Health Requirements Manual EM 385-1-1.

Trench sheeting may be removed only if the pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting. Trench sheeting shall not be pulled after backfilling. With the concurrence of the Contracting Officer, sheeting shall be left permanently in the trench.

Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

3.6 STABILIZATION. Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workers.

Subgrades for concrete structures or trench bottoms which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not more than 4 inches; if the required depth exceeds 4 inches, the material shall be furnished and installed as specified for granular fills. The finished elevation of stabilized subgrades shall not be above subgrade elevations indicated on the drawings.

3.7 GRANULAR FILLS. Granular fills shall be provided where indicated on the drawings. Granular fills shall be placed on suitably

prepared subgrades and compacted by vibration. Granular fills shall be compacted to not less than 70 percent relative density as determined by ASTM D4253 and D4254.

3.8 TRENCH EXCAVATION. No more trench shall be opened in advance of pipe laying than is necessary to expedite the work. One block or 400 feet, whichever is the shorter, shall be the maximum length of open trench on any line under construction.

Except where tunneling is indicated on the drawings, is specified, or is permitted by the Contracting Officer, all trench excavation shall be open cut from the surface.

3.8.1 Alignment, Grade, and Minimum Cover. The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe.

3.8.2 Limiting Trench Widths. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. Minimum trench widths shall be as follows:

MINIMUM TRENCH WIDTHS

<u>Nominal Pipe Size</u> inches	<u>Minimum Trench Width</u> inches	<u>Minimum Sidewall Clearance</u> inches
Less than 27	Pipe OD plus 24	12

Specified minimum sidewall clearances are not minimum average clearances but are minimum clear distances which will be required to the trench excavation or the trench protective system.

Cutting trench banks on slopes to reduce earth load to prevent sliding and caving shall be used only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits

3.8.3 Mechanical Excavation. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

3.8.4 Cutting Concrete Surface Construction. Cuts in asphaltic concrete pavement and base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with a concrete saw in a manner which will provide a clean groove at least 1-1/2 inches deep along each side of the trench and along the perimeter of cuts for structures.

Asphaltic Concrete pavement and concrete base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 6 inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the center line of the trench.

Pavement removal for connections to existing lines or structures shall not exceed the extent necessary for the installation.

Where the trench parallels the length of concrete walks, and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and subsequently replaced between existing joints or between saw cuts as specified for pavement.

3.8.5 Excavation Below Pipe Subgrade. Except where otherwise required, pipe trenches shall be excavated below the underside of the pipe, as indicated on Figure 1-02200, to provide for the installation of granular embedment.

3.8.6 Artificial Foundations in Trenches. Whenever unsuitable or unstable soil conditions are encountered, trenches shall be excavated below grade and the trench bottom shall be brought to grade with suitable material. In such cases, adjustments will be made in the Contract Price.

3.8.7 Bell Holes. Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

3.9 PIPE EMBEDMENT. Embedment materials both below and above the bottom of the pipe, classes of embedment to be used, and placement and compaction of embedment materials shall conform to the requirements of Missouri Standard Plans for Highway Construction.

Embedment material shall contain no cinders, clay lumps, or other material which may cause pipe corrosion.

3.9.1 Placement and Compaction. Granular embedment material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle.

After each pipe has been graded, aligned, and placed in final position on the bedding material, and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations.

Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

Each lift of granular embedment material shall be vibrated with a mechanical probe type vibrator during placement to ensure that all spaces beneath the pipe are filled. Each lift of embedment material shall be compacted with a platform type vibrating compactor to at least 70 percent relative density as determined by ASTM D4253 and D4254.

3.10 TRENCH BACKFILL. All trench backfill above pipe embedment shall conform to the following requirements.

A layer of backfill material not more than 8 inches deep may be placed over concrete arch encasement or concrete reaction blocking after the concrete has reached its initial set, to aid curing. No additional

backfill shall be placed over arch encasement or blocking until the concrete has been in place for at least 3 days.

3.10.1 Compacted Backfill. Compacted backfill will be required for the full depth of the trench above the embedment in the following locations:

Where beneath pavements, surfacings, driveways, curbs, gutters, walks, or other surface construction or structures.

Where in street, road, or highway shoulders.

At the option of the Contractor, compacted backfill may be (a) suitable job excavated material, (b) inundated sand, or (c) graded gravel, as described below:

a. Job Excavated Material. Job excavated material may be used for compacted backfill when the job excavated material is finely divided and free from debris, organic material, cinders, any corrosive material, and stones larger than 3 inches in greatest dimension. Masses of moist, stiff clay shall not be used. Job excavated materials shall be placed in uniform layers not exceeding 8 inches in uncompacted thickness. Each layer of material shall have the best possible moisture content for satisfactory compaction. The material in each layer shall be wetted or dried as required and thoroughly mixed to ensure uniform moisture content and adequate compaction. Increased layer thickness may be permitted for noncohesive material if the Contractor demonstrates to the satisfaction of the Contracting Officer that the specified compacted density will be obtained. The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe. Job excavated material shall be compacted to 95 percent of maximum density at optimum moisture content, as determined by ASTM D698 when that test is appropriate, or to 70 percent relative density, as determined by ASTM D4253 and D4254 when those tests are appropriate.

b. Inundated Sand. Sand shall be deposited in, or placed simultaneously with the application of, water so that the sand is inundated during compaction. During placement, the sand shall be compacted with a mechanical probe type vibrator. Inundated sand shall be compacted to 70 percent relative density as determined by ASTM D4253 and D4254.

c. Graded Gravel. Gravel backfill shall be deposited in uniform layers not exceeding 12 inches in uncompacted thickness. The backfill shall be compacted with a suitable vibratory roller or platform vibrator to at least 70 percent relative density as determined by ASTM D4253 and D4254.

3.10.2 Uncompacted Backfill. Compaction of trench backfill above pipe embedment in locations other than those specified will not be required except to the extent necessary to prevent future settlement. The Contractor shall be responsible for backfill settlement as specified.

Uncompacted earth backfill material to be placed above embedments shall be free of brush, roots more than 2 inches in diameter, debris, cinders, and any corrosive material, but may contain rubble and detritus from rock excavation, stones, and boulders in certain portions of the trench depth.

Uncompacted backfill material above embedments shall be placed by methods which will not impose excessive concentrated or unbalanced

loads, shock, or impact on installed pipe, and which will not result in displacement of the pipe.

Compact masses of stiff clay or other consolidated material more than 1 cubic foot in volume shall not be permitted to fall more than 5 feet into the trench, unless cushioned by at least 2 feet of loose backfill above pipe embedment.

No uncompacted trench backfill material containing rocks or rock excavation detritus shall be placed in the upper 18 inches of the trench, nor shall any stone larger than 8 inches in its greatest dimension be placed within 3 feet of the top of pipe. Large stones may be placed in the remainder of the trench backfill only if well separated and so arranged that no interference with backfill settlement will result.

3.11 STRUCTURE BACKFILL. Backfill around structures shall be compacted to the extent necessary to prevent future settlement. Water settlement will be permitted only where it would cause no damage to the work.

Material for backfill shall be composed of earth only and shall contain no wood, grass, roots, broken concrete, stones, trash, or debris of any kind. No tamped or otherwise mechanically compacted backfill shall be deposited or compacted in water.

3.12 INTERRUPTION OF TRAFFIC. No interruption of traffic will be permitted at any location where bored crossings are required.

3.13 DRAINAGE MAINTENANCE. Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or watercourses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other watercourses crossed by the line of trench shall be removed immediately after backfilling is completed, and the original section, grades, and contours of ditches or watercourses shall be restored. Surface drainage shall not be obstructed longer than necessary.

3.14 PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSES. Where trenches are constructed in ditches or other watercourses, backfill shall be protected from surface erosion. Where the grade of the ditch exceeds 1 percent, ditch checks shall be installed. Unless otherwise indicated on the drawings, ditch checks shall be concrete. Ditch checks shall extend at least 2 feet below the original ditch or watercourse bottom for the full bottom width and at least 18 inches into the side slopes, and shall be at least 12 inches thick.

3.15 FINAL GRADING AND PLACEMENT OF TOPSOIL. After other outside work has been finished, and backfilling and embankments completed and settled, all areas which are to be graded shall be brought to grade at the indicated elevations, slopes, and contours. All cuts, fills, embankments, and other areas which have been disturbed or damaged by construction operations shall be surfaced with topsoil to a depth of at least 4 inches. Topsoil shall be of a quality at least equal to the existing topsoil in adjacent areas, free from trash, stones, and debris, and well suited to support plant growth.

Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to manual methods. All surfaces shall be graded to secure effective drainage. Unless otherwise indicated, a slope of at least 1 percent shall be provided.

Final grades and surfaces shall be smooth, even, and free from clods and stones, weeds, brush, and other debris.

3.16 DISPOSAL OF EXCESS EXCAVATED MATERIALS. Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site of the work.

Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be installed in trench backfill, debris encountered in excavation work, and other similar waste materials shall be disposed of away from the site of the work.

Excess earth from excavations located in unimproved property may be distributed directly over the pipe trench and within the pipeline right-of-way to a maximum depth of 6 inches above the original ground surface elevation at and across the trench and sloping uniformly each way. Material thus wasted shall be carefully finished with a drag, blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point. Wasting of excess excavated material in the above manner will not be permitted where the line of trench crosses or is within a railroad, public road, or highway right-of-way. The disposal of waste and excess excavated materials, including hauling, handling, grading, and surfacing shall be a subsidiary obligation of the Contractor and no separate payment will be made therefor.

3.17 SETTLEMENT. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within the correction period.

The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Contracting Officer.

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SECTION 02222 - EMBANKMENT

PART 1 - GENERAL

1.1 SCOPE. The work covered by this section consists of furnishing all plant, labor, equipment, and performing all operations in connection with foundation preparation and construction of embankments as shown on the drawings and as hereinafter specified.

1.2 QUALITY CONTROL.

1.2.1 General. The Contractor shall establish and maintain quality control for embankment construction operations to assure compliance with contract requirements, and maintain records of its quality control for all construction operations including but not limited to the following:

(1) Equipment. Type, size, and suitability for construction of the prescribed work.

(2) Foundation Preparation. Breaking surface in advance of embankment construction, and during fill placement when necessary, drainage of foundation and partially completed fill.

(3) Materials. Suitability of materials for use in embankment and backfills.

(4) Construction. Layout, maintaining existing drainage, thickness of layers, spreading and compacting.

(5) Grade and Cross Section. Side slopes and grades.

(6) Grade Tolerances. Check fills to determine if placement conforms to prescribed grade and cross section.

(7) Slides. Location and limits; methods and equipment.

(8) Materials Testing and Inspection. The Contractor shall be responsible for ensuring that all required testing, and any additional testing required by the Contracting Officer, is performed. All testing shall be performed in accordance with Section 01440.

1.2.2 Reporting. A copy of these records of inspections and tests, as well as the records of corrective action taken, shall be furnished the Government daily.

1.3 SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted to the Contracting Officer in accordance with SECTION 01300 - SUBMITTAL PROCEDURES.

1.3.1 Reports. Soil Test Results; FIO. Submit soil classification

and moisture density test results as specified.

1.3.2 Certificates. Soil Testing Lab; FIO. Submit the name and address of the verified soil testing lab prior to commencing any earthwork.

1.3.3 Data. Compaction Equipment; GA. The Contractor shall submit for review and approval compaction equipment that will achieve the compaction requirements specified. The suitability of the equipment shall be demonstrated to the Contracting Officer by a field test conducted by and at the expense of the Contractor.

1.4 REFERENCES. The following publications, referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto:

1.4.1 American Society for Testing and Materials (ASTM).

ASTM D 698	(1991; R 1997) Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place By The Sand-Cone Method
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 4318	(1995, Rev A) Liquid Limit, Plastic Limit and Plasticity Index of Soils

PART 2 - PRODUCTS

2.1 EQUIPMENT.

2.1.1 Crawler-Type Tractors. Crawler-type tractors used for spreading or compacting shall weigh not less than 20,000 pounds, shall exert a unit tread pressure of not less than 6 pounds per square inch, and shall be operated at speeds not to exceed 3.5 miles per hour.

2.1.2 The Contractor shall submit for review and approval compaction equipment that will achieve the compaction requirements specified. The suitability of the equipment shall be demonstrated to the Contracting Officer by a field test conducted by and at the expense of the Contractor. The compaction equipment shall be capable of properly compacting the soil so that no planes of weakness or laminations are formed in the fill. Testing and

inspection of the placed material shall be then be performed by the Contractor at no additional expense to the Government.

2.1.3 Sprinkling Equipment. Sprinkling equipment used for moisture control shall be designed to apply water uniformly and in controlled quantities to variable widths of surface.

2.1.4 Miscellaneous Equipment. Scarifiers, disks, trash pumps, ditching equipment, power tampers, and other equipment shall be types suitable for construction of embankment.

2.2 EMBANKMENT MATERIALS.

2.2.1 General. The embankment shall be constructed of earth obtained from the excavation as prescribed in SECTION 02110 - STRIPPING AND EXCAVATION.

The embankment shall be constructed of impervious fill that is free from unsuitable and frozen materials. Unless otherwise specified, material classified by the Unified Soil Classification System as gravels (GW, GP, GM), sands (SW, SP, SM), and non-plastic silts (ML) shall not be used.

2.2.1.1 Contractor-Furnished Borrow The Contractor may furnish borrow to be used for backfill material. The borrow area location and dimensions must be approved by the Contracting Officer, and the character of the material therein, as indicated by Government-selected tests of soil samples performed by an independent, Corps of Engineers verified laboratory at the Contractor's expense, must be adequate for the intended use. The Contractor shall demonstrate compliance by furnishing the test results from a minimum of three soil samples. The Contractor shall maintain constant quality control due to variables in the soil. Written evidence must be submitted to the Contracting Officer that the Contractor has obtained property rights and access to the material therein. The written evidence shall consists of an authenticated copy of the conveyance under which the Contractor acquired the property rights and access thereto, prepared and executed in accordance with the laws of the State of Missouri. The Contracting Officer reserves the right to approve or disapprove the use of Contractor-furnished borrow areas located in woodlands or wetlands based on the location of the areas and a determination of the overall impact the proposed excavation will have on the environment. No time extension in contract completion will be granted for delays incurred in obtaining Contractor-furnished borrow areas. The Contractor shall be solely responsible for any and all damages, claims for damages, and liability of any nature whatsoever arising from or growing out of the use of Contractor-furnished borrow areas. Approval of location and dimensions of Contractor-furnished borrow areas shall neither relieve the Contractor from the obligation to furnish satisfactory material, nor in any way commit the Government either to acceptance of unsatisfactory material, or to responsibility for the character, quantity, or availability of material in such borrow areas.

2.2.2 Impervious Fill. Materials which are classified as impervious fill is that material designated as CL, by the Unified Soil Classification System.

2.2.3 Unsuitable Materials. Materials which are classified as unsuitable for embankment material are defined as masses of organic matter, sticks, branches, roots, and other debris. It also includes materials that do not meet the soil classifications listed for impervious fill. Not more than 1 percent by volume of objectionable material shall be contained in the earth material placed in each cubic yard of the spoil bank section. Pockets and/or zones of wood shall not be placed in the embankment.

2.2.4 Frozen Materials. Under no circumstances shall frozen earth, snow or ice be placed in an embankment or disposal area.

PART 3 - EXECUTION

3.1 EMBANKMENT FOUNDATION PREPARATION.

3.1.1 General. After clearing, grubbing, and stripping, the entire earth surface on or against which fill is to be placed shall be thoroughly scarified to a depth of 6 inches. If for any cause, this scarified surface becomes compacted in such a manner that, in the opinion of the Contracting Officer, a plane of weakness might be induced, it shall again be adequately scarified before depositing material thereon.

3.1.2 Drainage. All foundations receiving fill and all partially completed fill shall be kept thoroughly drained. The Contractor shall drain or pump water from any area to receive fill.

3.1.3 Frozen Ground. Fill shall not be placed upon frozen ground.

3.2 EMBANKMENT CONSTRUCTION.

3.2.1 Impervious Fill.

3.2.1.1 General. Impervious fill shall not be placed in water, or on wet, saturated or loose ground. Wet ground shall be disked or allowed to dry until firm enough to permit fill placement, or the wet ground shall be removed at no additional cost to the Government. The materials for fill shall be placed or spread in layers, the first layer not more than 6 inches in thickness and the succeeding layers not more than 8 inches in thickness prior to compaction. Layers shall be started full out to the slope stakes and shall be carried substantially horizontal and parallel to the roadway centerline with sufficient crown or slope to provide satisfactory drainage during construction. Benching into the slope of the existing embankment is required in order to place and compact the material in horizontal layers. The vertical face of the existing embankment resulting from the benching operation shall be a minimum of one foot in height but shall not exceed two feet in height. When the surface of any compacted layer is too smooth to bond properly with the succeeding layer, it shall be adequately scarified to a depth of 6 inches before the next layer is placed thereon.

3.2.1.2 Moisture Control. The materials in each layer of the fill shall be tested in accordance with ASTM D 2216 and shall contain the amount of

moisture, within the limits specified below or as directed by the Contracting Officer, necessary to obtain the desired compaction as determined by ASTM D 698. Material that is not within the specified limits after compaction shall be reworked, regardless of density. The moisture content after compaction shall be as uniform as practicable throughout any one layer of impervious materials. The moisture content after compaction shall be within the limits of plus 2 percentage points above optimum and minus 2 percentage points below optimum moisture content as determined by the Contracting Officer. Material that is too wet shall be spread on the embankment and permitted to dry, assisted by disking or harrowing, if necessary, until the moisture content is reduced to an amount within the specified limits. When the material is too dry, the Contractor shall be required to sprinkle each layer on the fill. Harrowing, or other approved methods shall be required to work the moisture into the material until a uniform distribution of moisture is obtained. Water applied on a layer of fill shall be accurately controlled in amount so that free water shall not appear on the surface during or subsequent to rolling. Should too much water be added to any part of the embankment, so that the material is too wet to obtain the desired compaction, the rolling on that section of the embankment shall be delayed until the moisture content of the material is reduced to an amount within the specified limits. If it is impracticable to obtain the specified moisture content by wetting or drying the material on the fill, the Contractor may be required to prewet or dry back the material at the sources of excavation. If, in the opinion of the Contracting Officer, the top or contact surfaces of the partial fill section become too dry to permit suitable bond between these surfaces and the additional fill to be placed thereon, the Contractor shall loosen the dried materials by scarifying or disking to such depths as may be directed by the Contracting Officer, shall dampen the loosened material to an acceptable moisture content, and shall compact this layer in accordance with the requirements of this paragraph.

3.2.1.3 Compaction. Compaction of impervious material shall be accomplished with approved equipment specified in 02222-2.1. The moisture content and conditions of each spread layer shall conform to the specifications and each layer of material shall be compacted to at least 95 percent of the maximum dry density as determined in accordance with ASTM D 698. Determination of in-place density shall be in accordance with ASTM D 1556 or ASTM D 2937. The Contractor shall ensure that its compaction methods do not damage any existing utilities. Any damage caused by the Contractor's operation shall be repaired at the Contractor's expense.

3.2.2 Dressing. The entire embankment shall be brought to not less than the prescribed design cross section within allowable tolerance, at all points. Unreasonable roughness of surface shall be dressed out to permit turving operations.

3.2.3 Care of Water. The foundation receiving embankment and all partially completed fill shall be kept thoroughly drained. The Contractor shall control the earthwork to prevent water from flowing into the work area.

3.3 CROSS SECTIONS OF MATERIALS. Unless otherwise specified, the dimensions and slopes shall conform to the applicable cross sections, within

allowable tolerance, shown on the drawings.

3.4 GRADE TOLERANCES. All embankments shall be constructed to the design grade and cross section shown on the drawings. For all fill, at all points, a tolerance of 1/10 of 1 foot at the crown and 3/10 of 1 foot elsewhere above or below the prescribed design grade and cross section shown will be permitted in the final dressing provided that the crown of the spoil bank drains, there are no abrupt humps or depressions in surfaces or bulges in the width of the crown, and the side slopes are uniform. Any partial fill or temporarily stockpiled material placed within the design section shall not exceed the design grade or design slopes of the embankment by more than one foot, and shall have side slopes not steeper than 1V on 2H.

3.5 SLIDES. Should sliding occur in any part of the embankment during its construction, or after its completion, but prior to its acceptance, the Contractor shall, upon written order of the Contracting Officer, either cut out and remove the slide from the embankment and then rebuild that portion of the embankment, or construct a stability berm of such dimensions, and placed in such manner, as the Contracting Officer shall prescribe. In case the slide is caused through fault of the Contractor, the foregoing operations shall be performed at no additional cost to the Government. In case the slide is not the fault of the Contractor, the material ordered removed will be paid by an equitable adjustment according to the Contract Clause entitled "Changes", and the material replaced. The method of slide correction shall be determined by the Contracting Officer.

3.6 TESTING.

3.6.1 Soil Classification Tests. Soil classification tests shall be performed in accordance with ASTM D 2487. The Contractor shall furnish the results of the initial classification test for each material from each designated borrow area at least 30 days prior to placing the fill. The Contractor shall perform one test for each designated borrow area. The Contractor shall perform one classification test for each in-place density test as specified in 02222-1.4.1. Additional tests may be required by the Contracting Officer if the material in any borrow area appears to be noticeably different from that which was tested.

3.6.2 Moisture Density Relationships. The moisture-density relations of the impervious fill material shall be determined in accordance with ASTM D 698, Method A. The Contractor shall furnish the results of the initial moisture density test for each material from each designated borrow area at least 30 days prior to placing the fill. The Contractor shall perform one test for each designated borrow area and each additional 10,000 CY. Additional tests may be required by the Contracting Officer if the material in any borrow area appears to be noticeably different from that which was tested.

3.6.3 In-Place Density Testing. The in-place density of the impervious fill materials shall be accomplished at the direction of the Contracting Officer in accordance with ASTM D 2937 or ASTM D 1556. At least one (1) in-place density test shall be performed on every 500 cubic yards of fill placed, with a minimum of one per working day. The in-place soil density shall be

compared to the requirements of 02222-3.2.1.3. Fill not meeting the required specifications for in-place density shall be retested, at no additional cost to the Government, after additional compaction has been completed.

3.6.4 Water (Moisture) Content Tests. Determination of in-place water content shall be performed in accordance with ASTM D 2216 and shall be performed on all in-place density tests. Embankment fill not meeting the required specifications for water content shall be retested, at no additional cost to the Government, after corrective measures have been applied.

3.6.5 Additional Testing. The Contracting Officer may request additional tests if:

- (1) There is reason to doubt the adequacy of the compaction.
- (2) Special compaction procedures are being used.
- (3) Materials change and the Contracting Officer determines that the Contractor's testing is inadequate.

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SECTION 02230 - CRUSHED STONE SURFACING

PART 1 - GENERAL

1.1 SCOPE. The work covered by this section of the specifications consists of furnishing all plant, labor, equipment and materials, and performing all work necessary for crushed stone surfacing as shown on the drawings and as specified herein.

1.2 QUALITY CONTROL.

1.2.1 General. The Contractor shall establish and maintain quality control for all operations to assure compliance with contract requirements and maintain records of its quality control for all construction operations, including but not limited to the following:

- (1) Preparation of subgrade
- (2) Placement of geotextile
- (3) Crushed stone surface course (materials, placing)

1.2.2 Reporting. A copy of these records, as well as the records of corrective action taken, shall be furnished to the Government daily.

1.3 APPLICABLE SPECIFICATIONS. The materials for, and construction of the crushed stone surface course shall conform to the applicable provisions of the hereinafter cited sections and articles of the Missouri Highway and Transportation Commission (MHTC), "Missouri Standard Specifications for Highway Construction" dated 1999, and subsequent revisions, unless otherwise specified. The term "Engineer" as used therein shall be interpreted to mean "Contracting Officer."

1.4 SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted to the Contracting Officer in accordance with SECTION 01300 - SUBMITTAL PROCEDURES.

1.4.1 Statements. Aggregate Sources; GA. Material source(s) as specified in Paragraph 2.3 SOURCES AND SAMPLING.

1.4.2 Samples. Aggregate Samples; GA. Samples of aggregate as specified in Paragraph 2.3 SOURCES AND SAMPLING.

1.4.3 Reports. Testing Reports; GA. Testing results as specified in Paragraph 3.5 TESTING.

PART 2 - PRODUCTS

2.1 GEOTEXTILE. Geotextile materials shall conform to the requirements of SECTION 02240 - GEOTEXTILE.

2.2 CRUSHED STONE SURFACING. The crushed stone surfacing shall be a 9-inch layer of Type 1 aggregate conforming to the requirements of SECTION 1007, AGGREGATE FOR BASE, Article 1007.1. The aggregates shall conform to the following gradation requirements:

<u>Passing Sieve</u>	<u>Percent by Weight</u>
1 inch	100
1/2 inch	60-90
No. 4	40-60
No. 40	15-35

The fraction passing the No. 40 sieve shall have a plasticity index not to exceed six.

2.3 SOURCES AND SAMPLING. It shall be the responsibility of the Contractor to make its own investigations for a source of a suitable material and to make its own arrangements with the owners of the pits for procuring the required quantity of suitable material. After the award of the contract and at least 30 calendar days prior to placing, the Contractor shall designate in writing only one source or one combination of sources from which it proposes to furnish aggregate. Samples shall be provided to the Contracting Officer at the construction site at the expense of the Contractor. See paragraph 3.5.2 Approval of Material for test requirements. Approval of samples from a source of aggregate is not to be construed as approval of all materials from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels when such materials are unsuitable for aggregate as determined by the Contracting Officer. Materials produced from an approved source shall meet all the requirements of this section.

PART 3 - EXECUTION

3.1 INSTALLATION OF CRUSHED STONE SURFACING. Crushed stone shall be installed in accordance with SECTION 304, AGGREGATE BASE COURSE, except Articles 304.3.1, and all of 304.4 and 304.5. The Contractor shall repair any damage to the completed crushed stone surface, caused by construction operations, at no additional cost to the Government.

3.2 WEATHER LIMITATIONS. Aggregate base course shall not be constructed when the atmosphere temperature is less than 35°F or when the subgrades are frozen or contain frost. If the temperature falls below 35°F, completed areas shall be protected against any detrimental effects of freezing, rainfall, or other weather conditions. Any detrimental effects shall be corrected to meet the specified requirement at no additional cost to the Government.

3.3 EQUIPMENT. Equipment, plant, and tools used in the work shall be subject to approval, shall be maintained in satisfactory working condition,

and unless specified or approved otherwise, shall meet the requirements of the referenced MHTC sections.

3.4 CONSTRUCTION.

3.4.1 Operation of Aggregate Source. Stripping, and excavating shall be the responsibility of the Contractor. The aggregate sources shall be operated in such a manner as to produce the quantity and quality of base course materials meeting these specification requirements in the specified time limits. Aggregate sources on private lands shall be conditioned in agreement with local laws or authorities.

3.4.2 General. Materials shall be placed on geotextile in all areas shown on the drawings. The material shall be placed in a 9 inch lift prior to compaction. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the area to be constructed. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining. The Contractor may use an approved laser system in lieu of a grade stake system.

3.4.3 Grade Control. The Contracting Officer will make random field measurements to ensure that 9 inches of pre-compacted material is being placed.

3.4.4 Compaction. The crushed stone surfacing shall be constructed in accordance with the MHTC references listed.

3.4.7 Finishing. The surface of the crushed stone surfacing shall be finished to a uniform texture. Light blading during compaction may be necessary to ensure that is not any ponding of water. Should the surface for any reason become rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portion shall be scarified, reworked, or replaced as directed.

3.5 TESTING. The following tests shall be performed by and at the expense of the Contractor. Samples shall be taken when and where directed. Tests of materials not meeting the requirements specified will not be counted as part of the required tests. Copies of test results shall be maintained and, if requested, made available for review by the Contracting Officer.

3.5.1 Sieve Analysis (ASTM C 117 and ASTM C 136). One test prior to placing. When any source of materials is changed or deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced. Unacceptable materials shall be disposed of as unsatisfactory materials.

3.5.2 Approval of Material. The source of material to be used for producing aggregates shall be selected 30 days prior to the time the material shall be required in the work. Tentative approval of the source will be based on an inspection by the Contracting Officer. Tentative approval of material

will be based on gradation tests of samples for the specific job. Final approval of both the source and the material will be based on tests for gradation performed on samples taken from the completed and compacted aggregate base course.

3.5.3 Compaction. The crushed stone surfacing shall be tested for compaction in accordance with the MHTC standards listed at least once every 100 tons that the aggregate is placed.

3.6 MAINTENANCE. The crushed stone surfacing shall be maintained in a condition that shall meet all specification requirements until accepted by the Government.

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SECTION 02240 - GEOTEXTILE

PART 1 GENERAL

1.1 SCOPE. The work provided for herein consists of furnishing all plant, labor, material, and equipment and performing all operations required for furnishing, hauling, and placing the geotextile, complete, as specified herein and shown on the contract drawings, and maintaining the geotextile until acceptance.

1.2 QUALITY CONTROL.

1.2.1 General. The Contractor shall establish and maintain quality control for operations under this section to assure compliance with contract requirements and maintain records of its quality control for all materials, equipment, and construction operations, including but not limited to the following:

- (a) Materials
- (b) Installation

1.2.2 Reporting. A copy of the records of inspection and tests, as well as the records of corrective action taken, shall be furnished to the Government, daily.

1.3 APPLICABLE PUBLICATIONS. The following publications of the current issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

1.3.1 American Society for Testing and Materials (ASTM).

D 4632-91 (R1996)	Grab Breaking Load and Elongation of Geotextiles
D 4751-99a	Determining Apparent Opening Size of a Geotextile
D 4833-00	Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

1.4 SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted to the Contracting Officer in accordance with SECTION 01300 - SUBMITTAL PROCEDURES.

1.4.1 Certificates. GA. Submit certificates of compliance attesting that the geotextile meets specification requirements.

1.4.2 Statement. FIO. Method of Installation. Submit the method of installation, equipment to be used, and the manufacturer's recommendations of placement and securing the geotextile.

1.5 SHIPMENT AND STORAGE. The geotextile shall be furnished in a protective wrapping which shall protect the geotextile from direct sunlight, ultra-violet rays, temperatures greater than 140 degree Fahrenheit, mud, dirt, dust and debris. To the extent possible, the fabric shall be maintained wrapped in a heavy-duty protective covering.

PART 2 PRODUCTS

2.1 GEOTEXTILE. The geotextile shall be of nonwoven sheet construction and consist of long chain polymeric fabric composed of polypropylene, polyethylene, polyester, polyamide or polyvinylidene-chloride fibers weighing 4.0 to 8.0 ounces per square yard, and shall contain stabilizers and/or inhibitors added to the basic plastic if, necessary, to make the filaments resistant to deterioration due to ultraviolet and heat exposure. The fibers shall be oriented into a random web and stabilized whereby they retain there positions relative with each other. The geotextile shall be free of any chemical treatment or coating, which reduces permeability and shall be inert to chemicals commonly found in soil. The edges of the geotextile shall be finished to prevent the outer fiber from pulling away from the geotextile. The geotextile shall conform to the following physical property requirements:

<u>Physical Property</u>	<u>Test Procedure</u>	<u>Acceptable Values*</u>
Tensile Strength (Wet)	ASTM D 4632	120 pound minimum in any principal direction
Elongation - (Wet)	ASTM D 4632	At least 15 percent but no greater than 80 percent in any principal direction
Apparent Opening Size	ASTM D 4751	No finer than No. 100 No coarser than No. 70 U.S. Standard Sieve
Puncture Strength	ASTM D 4833	75 pounds minimum

*Unless stated otherwise all numerical values represent average roll values (i.e. any roll in a lot should meet or exceed the minimum value but not exceed the maximum value listed in the table.)

PART 3 EXECUTION

3.1 GEOTEXTILE INSTALLATION AND PROTECTION.

3.1.1 Installation. The geotextile shall be placed in the manner and locations shown on the drawings. At the time of installation the geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacturing, transportation, storage or installation and shall be replaced at no additional cost to the Government. The surface to receive the geotextile shall be prepared to a relatively smooth condition free of obstructions, depressions and debris. Erosion features such as rills, gullies, etc. shall be graded out of the surface before geotextile placement. The geotextile shall be laid smooth and free of tension, stress folds, wrinkles or creases. The geotextile ends shall be overlapped and anchored per the manufacture's recommendation.

3.1.2 Geotextile Under Crushed Stone Surfacing. The Contractor shall place and secure the geotextile, width as shown on the drawings, centered under the entire length of the crushed stone roads to be constructed. The geotextile ends shall be overlapped by 2 feet and anchored per the manufacture's recommendation.

3.1.3 Protection of Geotextile. The geotextile shall be protected at all times during construction from contamination by surface run-off and any

geotextile so contaminated shall be removed and replaced with uncontaminated geotextile. The geotextile shall be covered with aggregate within 24 hours of placement. The Contractor at no cost to the Government shall replace any damage to the geotextile during its installation or during placement of aggregate.

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SECTION 02270
STONE PROTECTION

PART 1 - GENERAL

1.1 SCOPE. The work provided for herein consists of furnishing all plant, labor, equipment and materials, and performing all operations in connection with the construction of the stone protection, including foundation preparation, as shown on the contract drawings and specified herein.

1.2 QUALITY CONTROL.

1.2.1 General. The Contractor shall establish and maintain quality control for all stone protection operations to ensure compliance with contract requirements, and shall maintain records of the quality control for all construction operations, including but not limited to the following:

- (1) Foundation preparation (line and grade).
- (2) Inspection at the work site to ensure use of specified materials.
- (3) Bedding layer gradation and placement.
- (4) Riprap (Graded Stone C) gradation and placement.

1.2.2 Reporting. A copy of the records of inspection and tests, as well as the records of corrective action taken, shall be furnished to the Government daily.

1.3 REFERENCES. All publications referenced shall be the most current version, edition, standard, latest revision, or reapproval unless otherwise stated. The following publications and standards listed below will be referred to only by the basic designation thereafter, and shall form a part of this specification to the extent indicated by the references thereto:

1.3.1 American Society for Testing and Materials (ASTM).

C 127	Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate
C 136	Sieve Analysis of Fine and Coarse Aggregates

1.4 SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted to the Contracting Office in accordance with SECTION 01300 - SUBMITTAL PROCEDURES, and shall include, but not be limited to the following:

1.4.1 Source of Stone. GA. A list of stone source or sources shall be submitted at least 30 days prior to any placement of stone protection.

1.4.2 Gradation Test Data. GA. The results of all gradations shall be submitted within 24 hrs. after completion of the test.

1.4.3 Certified Weight Tickets. FIO.

1.4.4 Method of Placement. GA. A detailed description of the method for placing the bedding and Riprap (Graded Stone C) shall be submitted at least 30 days prior to any placement of material.

PART 2 - PRODUCTS

2.1 STONE MATERIALS.

2.1.1 General. All stone shall be durable material as approved by the Contracting Officer. The sources from which the Contractor proposes to obtain the materials shall be selected well in advance of the time when the material will be required. Stone protection materials shall be of a suitable quality to ensure permanence in the structure and in the climate in which it is to be used. It shall be free from cracks, seams, and other defects that would tend unduly to increase its deterioration from natural causes. The inclusion of objectionable quantities of dirt, sand, clay, and rock fines will not be permitted.

2.1.2 Sources and Evaluation Testing. All stone shall be obtained in accordance with the provisions in paragraph 32, STONE SOURCES of the Special Clauses. If the Contractor proposes to furnish stone from a source not listed in paragraph 32, the Contractor shall make such investigations as necessary to determine whether acceptable stone can be produced from the proposed source. Satisfactory service records on work outside the Corps of Engineers will be acceptable. If no such records are available, the Contractor shall make tests to ensure the acceptability of the stone. The tests to which the stone may be subjected will include petrographic analysis, specific gravity, abrasion, absorption, wetting and drying, freezing and thawing, and such other tests as may be considered necessary by the Contracting Officer. The following guidance is provided for use by the Contractor in analyzing a new source of stone. Stone that either weighs less than 155 pounds per cubic foot or has more than 2 percent absorption will not be accepted unless other tests and service records show that the stone is satisfactory. The method of tests for unit weight and absorption will be ASTM C 127 entitled Specific Gravity and Absorption of Coarse Aggregate. Samples of stone shall be taken by the Contractor under the supervision of the Contracting Officer at least 60 days in advance of the time the placing of the stone is expected to begin. The tests shall be conducted by the Contractor in accordance with applicable Corps of Engineers methods of test given in the Handbook of Concrete and Cement, and shall be performed at an approved testing laboratory. The cost of testing shall be borne by the Contractor.

2.1.3 Gradation Test. The Contractor shall perform a gradation test before the start of placement at the quarry in accordance with "LMVD Standard Test Method for Gradation of Riprap", a copy of which is attached at the end of this section. The sample shall be taken by the Contractor under the

supervision of the Contracting Officer, shall consist of not less than 15 tons of stone and shall be collected in a random manner that will provide a sample which accurately reflects the actual gradation arriving at the jobsite. If collected by the truckload, each truckload shall be representative of the gradation requirements. The Contractor shall provide all necessary screens, scales and other equipment, and the operating personnel therefore, and shall grade the sample, all at no additional cost to the Government. The Contractor shall perform at least one gradation test before the start of placement in accordance with ASTM C 136 on the bedding material. The gradation tests shall be reported using LMV Form 602-R, Gradation Test Data Sheet, a copy of which is attached at the end of this section. Additional tests, at the Contractor's expense, will be required if the stone furnished appears by visual inspection to be of questionable gradation.

2.2 BEDDING MATERIAL. Bedding material shall consist of crushed stone. The crushed material shall be composed of tough, durable particles, and shall be reasonably free from thin, flat and elongated pieces, and shall contain no organic matter nor soft, friable particles in quantities considered objectionable by the Contracting Officer. Grading shall conform to the following requirements:

Permissible Limits

<u>U.S. Standard Sieve</u>	<u>Percent by Weight Passing</u>
3-inch	90-100
1 1/2-inch	35-70
No. 4	0-5

Crushed stone shall be well-graded between the limits shown. All points on individual grading curves obtained from representative samples of bedding material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated grading limits plotted on a mechanical analysis diagram. The individual grading curves within these limits shall not exhibit abrupt changes in slope denoting either skip grading or scalping of certain sizes or other irregularities which would be detrimental to the proper functioning of the bedding layers.

2.3 RIPRAP (GRADED STONE C). Quarried rock only shall be used. Gradation shall conform to the tables below and to the gradation curves attached at the end of this section, and formats thereof shall be as shown. Neither the width nor the thickness of any piece shall be less than one-third of its length.

RIPRAP (GRADED STONE C)

STONE WEIGHT POUNDS(SSD)	CUMULATIVE PERCENT FINER BY WEIGHT
400	100
250	70-100
100	50-80
30	32-58
5	15-34
1	2-20
Less than .5 inch maximum dimension	0-5

5 percent of the material can weigh more than 400 pounds. No piece shall weigh more than 500 pounds.

PART 3 - EXECUTION

3.1 STONE PROTECTION MATERIALS

3.1.1 General. The stone protection materials may be placed subaqueously in water depths not to exceed 3 feet and the thickness of the layer shall be increase by 50 percent. The contractor shall take measures to allow the subaqueously placement of stone protection materials so that the lines and grade as shown on the drawing are not exceeded.

3.2 BASE PREPARATION. Areas on which the crushed stone bedding material and Riprap (Graded Stone C) are to be placed shall be excavated and/or dressed to conform to cross sections shown on the contract drawings within an allowable tolerance of plus 3 inches and minus 3 inches from the theoretical (slope) lines and grades. Where such areas are below the allowable minus tolerance limit they shall be brought to grade by being filled with suitable fill material. No additional payment will be made for any material thus required. Immediately prior to placing the crushed stone bedding material, and Riprap (Graded Stone C), the prepared base will be inspected by the Contracting Officer and no material shall be placed thereon until that area has been approved.

3.3 PLACEMENT OF BEDDING LAYER.

3.3.1 General. A bedding layer shall be placed on the prepared base as described in paragraph 02270-3.2, in accordance with the details and within the limits shown on the contract drawings, or staked in the field to form a backing for the stone protection.

3.3.2 Placement of Crushed Stone Bedding Material on Prepared Base.

Crushed stone bedding material shall be spread uniformly on the prepared base to the lines and grades as indicated on the contract drawings and in such manner as to avoid damage to the prepared base. Placing of crushed stone bedding material by methods that tend to segregate the particle sizes within the bedding layer will not be permitted. Any damage to the surface of the prepared base during placing of the bedding material shall be repaired before proceeding with the work. Compaction of bedding material placed on the prepared base will not be required, but the bedding layer shall be finished to present a reasonably even surface, free from mounds or windrows.

3.4 RIPRAP (GRADED STONE C) PLACEMENT. Riprap (Graded Stone C) shall be placed in a manner which will produce a reasonably well-graded mass of rock with the minimum practicable percentage of voids, and shall be constructed, within the specified tolerance, to the lines and grades either shown on the contract drawings or staked in the field. A tolerance of zero and not more than plus 9 inches for the Riprap (Graded Stone C) from the slope lines and grades shown on the contract drawings will be allowed in the finished surface of the Riprap (Graded Stone C), except that the extreme of this tolerance shall not be continuous over an area greater than 200 square feet. Riprap (Graded Stone C) shall be placed to its full course thickness in one operation and in such manner as to avoid displacing the bedding material. The larger stones shall be well distributed and the entire mass of stones in their final position shall be graded to conform to the gradation specified in paragraph 2.3. The finished Riprap (Graded Stone C) shall be free from objectionable pockets of small stones and clusters of larger stones. Placing Riprap (Graded Stone C) in layers will not be permitted. Placing Riprap (Graded Stone C) by dumping it into chutes, or by similar methods likely to cause segregation of the various sizes, will not be permitted. Placing Riprap (Graded Stone C) by dumping it at the top of the slope and pushing it down the slope will not be permitted. The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source, by controlled dumping of successive loads during placing, or by other methods of placement which will produce the specified results. The gate releasing mechanism shall be arranged so that it may be operated only from a location at or near the front of the truck. Each truckload shall be representative of the gradation requirements. Rearranging of individual stones by mechanical equipment or by hand will be required to the extent necessary to obtain a reasonably well-graded distribution of stone sizes as specified above. The Contractor shall maintain the Riprap (Graded Stone C) until accepted. Any material displaced prior to acceptance, due to the Contractor's negligence, shall be replaced at the Contractor own expense and to the lines and grades shown on the contract drawings.

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STANDARD TEST METHOD FOR GRADATION OF RIPRAP

- A. Select a representative sample (Note No. 1), weigh and dump on hard stand.
- B. Select specific sizes (see example) on which to run "individual weight larger than" test. (See Note No. 2). Procedure is similar to the standard aggregate gradation test for "individual weight retained."
- C. Determine the largest size stone in the sample. (100 percent size)
- D. Separate by "size larger than" the selected weights, starting with the larger sizes. Use reference stones, with identified weights, for visual comparison in separating the obviously "larger than" stones. Stones that appear close to the specific weight must be individually weighed to determine size grouping. Weigh each size group, either individually or cumulatively.
- E. Paragraph d above will result in "individual weight retained" figures. Calculate individual percent retained (heavier than), cumulative percent retained, and cumulative percent passing (lighter than). Plot percent passing, along with the specification curve on Eng Form 4055.

Notes

1. Sample Selection. The most important part of the test and least precise is the selection of a representative sample. No "standard" can be devised; larger quarry run stone is best sampled at the shot or muck pile by given direction to the loader; small graded riprap is best sampled by random selection from the transporting vehicles. If possible, all parties should take part in the sample selection, and agree before the sample is run, that the sample is representative.
2. Selection of Size for Separation. It is quite possible and accurate to run a gradation using any convenient sizes for the separation, without reference to the specifications. After the test is plotted on a curve, the gradation limits may be plotted. Overlapping gradation with this method are no problem. It is usually more convenient, however, to select points from the gradation limits, such as the minimum 50 percent size, the minimum 15 percent size, and one or two others, as separation points.

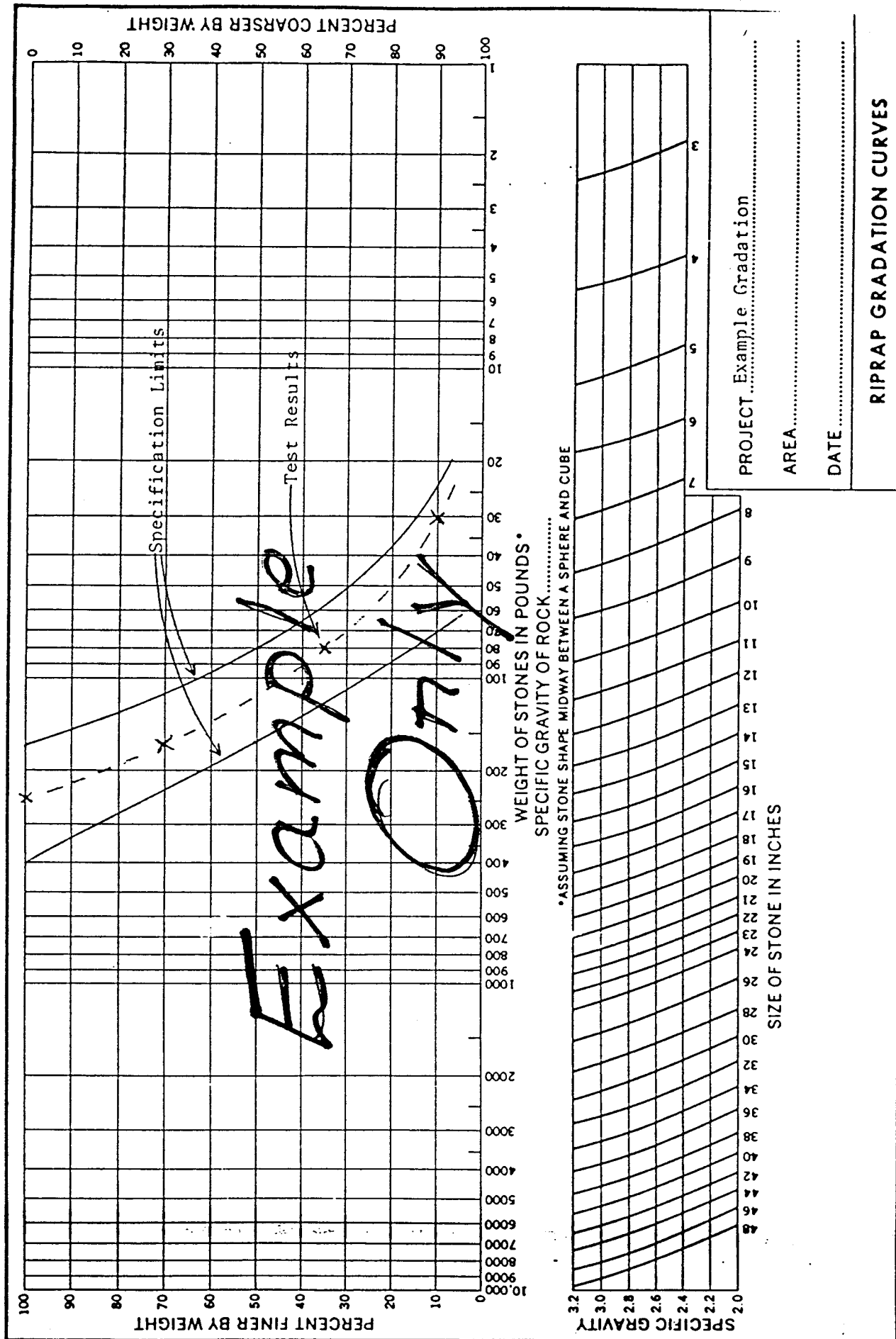
Example GradationSpecifications

<u>Stone Weight in Lbs</u>	<u>Percent Finer by Weight</u>
400-160	100
160-80	50
80-30	15

Example Worksheet

<u>Stone Size Lbs</u>	<u>Individual Wt. Retained</u>	<u>Individual Percent Retained</u>	<u>Cumulative Percent Retained</u>	<u>Cumulative Percent Passing</u>
400	0	0	-	100
160	9,600	30	30	70
80	11,200	35	65	35
30	8,000	25	90	10
30	<u>3,200</u>	10	100	-
	32,000 lbs			

NOTE:
Largest stone 251 lbs



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GRADATION TEST DATA SHEET

Sample No. : _____
 Type of _____
 Stone Tested _____
 Quarry _____
 Date of Test _____ Testing Rate _____ Tons
 Contractor _____ Location _____

TEST REPRESENTS

Tons

[illegible]

GRADATION

Specification
% Finer by wt

Total Weight					

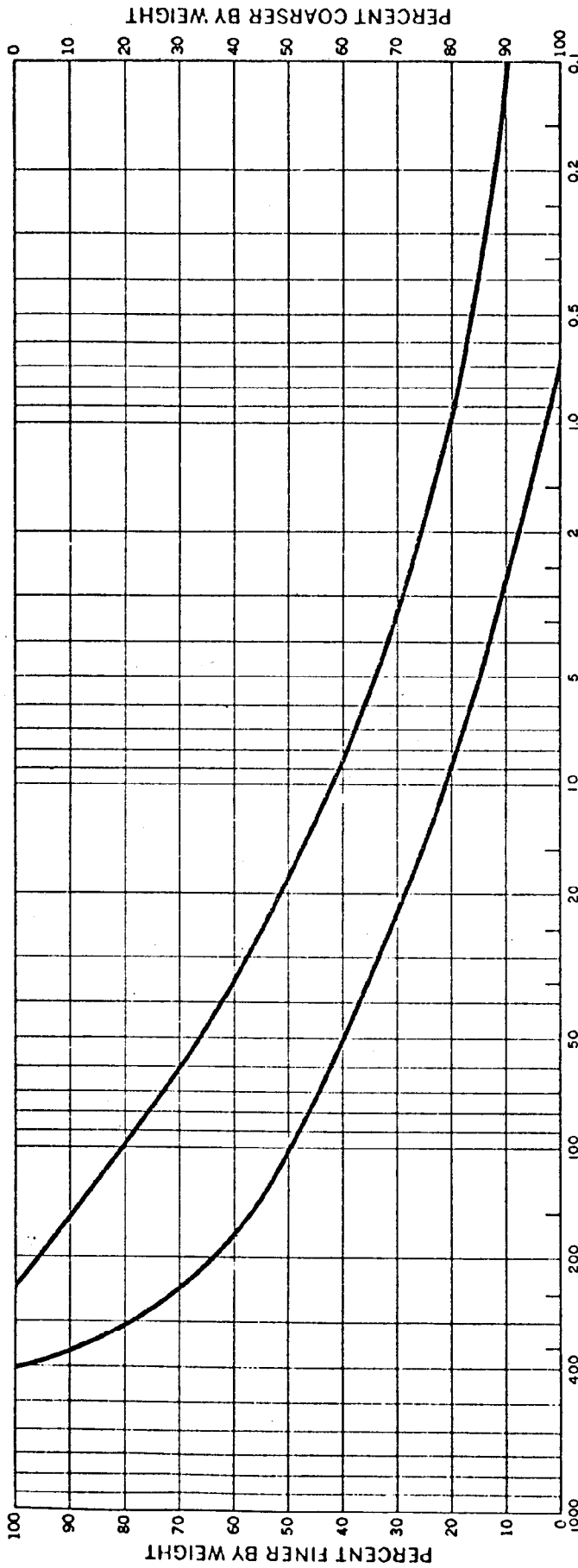
Remarks: _____

I certify that the above stone sample is representative of the total tonnage covered by this test report:

Contractor Representative _____

Government Representative _____

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STONE WEIGHT

(LBS)

- 400
- 250
- 100
- 30
- 5
- 1

less than 1/2" max dimension

CUMULATIVE %

FINER BY WEIGHT

- 100
- 70 - 100
- 50 - 80
- 32 - 58
- 15 - 34
- 2 - 20
- 0 - 5

NOTE: 5% of the material can weigh more than 400 pounds. However no piece shall weigh more than 500 pounds.

GRADATION

GRADED STONE C

September 1976

PLATE IV

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August 1999

STONE SOURCES
ST. LOUIS DISTRICT

Source No.	Producer	MRM*	Lat.	Long.
1.	Tower Rock Stone Co., Grays Point, Mo.	47.0	37N	89W
2.	West Lake Quarry, Neely's Landing, Mo.	71.5	37N	89W
3.	Tower Rock Stone Co., Ste Genevieve Mo.	127.6	38N	90W
4.	Plattin Quarry, Ste. Genevieve, Mo.	139.0	38N	90W
5.	Mississippi Lime Quarry, Ste. Genevieve, Mo.	155.0	38N	90W
6.	Barnhart Limestone Inc., Barnhart, Mo.	156.0	38N	90W
7.	Bussen Quarry, St. Louis County, Mo.	168.0	38N	90W
8.	Bellefontaine Quarry, Fort Bellefontaine, Mo.	8.0**	38N	90W
9.	Fort Belle Quarry, Ft. Bellefontaine, Mo.	7.0**	38N	90W
10.	Calhoun Quarry, Batchtown, Ill.	241.0	38N	90W
11.	Wayne Smith Quarry, Louisiana, Mo.	281.0	39N	91W
12.	Anna Quarry, Anna, Ill.		37N	89W
13.	Bussen Quarry, Eureka, Mo.		38N	90W
14.	Calender Quarry, Pittsfield, Ill.		39N	90W
15.	Central Stone Quarry #1, Huntington, Mo.		39N	91W
16.	Central Stone Quarry #9, Perry, Mo.		39N	91W
17.	Central Stone Quarry #33, Florence, Ill.		39N	91W
18.	Columbia Quarry Co. #15, Cypress, Ill.		37N	89E
19.	Charleston Stone Co., Charleston, Ill.		39N	88W
20.	Columbia Quarry #1, Columbia, Ill.		38N	90W
21.	Columbia Quarry #9, Dupo, Ill.		38N	90W

Source No.	Producer	MRM*	Lat.	Long.
22.	Falling Spring Quarry Co., Falling Springs, Ill.		38N	90W
23.	Magruder Quarry, Troy, Mo.		38N	90W
24.	Fred Weber Inc., Winfield Mo.		38N	90W
25.	Bluff City Mineral, E. Alton, Ill.		38N	90W
26.	Columbia Quarry Co. #7, Waterloo, Ill.		38N	90W
27.	Seminole Ag. Lime Co., Dexter, Mo.		37N	90W
28.	S-S-S Inc., New London, Mo.		39N	91W
29.	South East Mo. Stone Co., Cape Girardeau, Mo.		37N	89W
30.	Base Rock Mineral, (formally know as Resco, Inc.) Bonne Terre, Mo.		37N	90W
31.	Williamsville Stone Co., Poplar Bluff, Mo.		36N	90W
32.	Nokomis Quarry, Nokomis, Ill.		39N	89W
33.	Brickeys Stone Co., Bloomsdale, Mo.	136.0	38N	90W
34.	Martin Marietta Aggregate, Perryville, Mo.		37N	89W

* Mississippi River Mile

** Missouri River Mile

02611.4

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SECTION 02611 - REINFORCED CONCRETE PIPE FOR CULVERTS

PART 1 - GENERAL

1.1 SCOPE. The work covered by this section consists of furnishing all plant, labor, material, and equipment, and performing all operations necessary for the concrete pipe and appurtenances as specified herein and as shown on the drawings.

1.2 QUALITY CONTROL.

1.2.1 General. The Contractor shall establish and maintain quality control for all operations to assure compliance with contract requirements and maintain records of quality control for all construction operations, including, but not limited to the following:

- (1) Compaction
- (2) Installation of reinforced concrete drain pipe
- (3) Installation of geotextile.

1.2.2 Reporting. A copy of these records and tests, as well as the records of corrective action taken, shall be furnished to the Government daily.

1.3 APPLICABLE PUBLICATIONS. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

1.3.1 American Society for Testing and Materials (ASTM).

C 361-95	Reinforced Concrete Low-Head Pressure Pipe
C 655-95 (Rev A)	Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
C 1107-91 (Rev A)	Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
D 1310-86 (R 1990)	Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus
D 3776-85 (R 1990)	Mass per Unit Area (Weight) of Woven Fabric

1.4 SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having and "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01300 - SUBMITTAL PROCEDURES.

1.4.1 Reinforced Concrete Pipe. GA. Submit manufacturer's certificate of compliance for the reinforced concrete pipe.

1.4.2 Nonshrink Grout. GA. Submit manufacturer's certificate of compliance for the nonshrink grout material; and the method and equipment proposed for grout placement.

PART 2 - PRODUCTS

2.1 CULVERT PIPE. The culvert pipe shall be of the size indicated on the drawing and shall be reinforced concrete pipe conforming to the requirements of ASTM C 655.

2.2 NONSHRINK GROUT. The nonshrink grout shall consist of a prepackaged material conforming to the requirements of ASTM C 1107.

2.3 BACKFILL MATERIALS. Materials for pipe foundation fill shall be in accordance with the requirements of SECTION 02222.

PART 3 - EXECUTION

3.1 NONSHRINK GROUT PLACEMENT. Nonshrink grout shall be used to fill the voids between pipe and structures and patching holes in concrete. Temporary forms or collars shall be provided to contain the grout until the grout has set. Grout that has not been placed, for any reason, within 30 minutes after mixing shall not be used and shall be removed from the job site. The Contractor shall submit to the Contracting Officer for approval, the method and equipment proposed for placement of the grout. The nonshrink grout shall be mixed, placed, and cured in accordance with the manufacturer's recommendations.

3.2 PIPE FOUNDATION. The pipe foundation shall be accurately shaped to accept the lower 6 inches of the culvert pipe. The excavation shall be maintained in-the-dry and the Contractor shall be prepared to pump any surface or seepage water.

3.3 BACKFILL PLACEMENT. Placement of pipe foundation backfill within 4 feet horizontally and within a vertical dimension above the pipe as recommended by the pipe manufacturer shall be in accordance with the requirements of MHTC specification SECTION 726 RIGID PIPE CULVERTS, STORM DRAINS AND SEWERS, Article 726.6. Material shall not be placed in standing water.

3.4 BACKFILL COMPACTION. Compaction of each layer shall be in accordance with the requirements of SECTION 02222.

3.5 INSTALLATION OF CULVERT PIPE.

3.5.1 General. The culvert pipe is to be placed east of Terrapin Road and north of Warson. The final location is to be field verified and located by the COR. Prior to installing the culvert pipe, excavation and foundation preparation shall have been completed as prescribed in paragraph 3.2. Under no circumstances shall the pipe be laid in water, or when conditions or the weather are unsuitable for work. The pipe will be carefully inspected by the Contracting Officer immediately before it is laid and defective pipe will be rejected. Proper facilities shall be provided for lowering sections of pipe into place, and pipe shall be cleaned and lowered into position in such a manner as to avoid damage to the pipe. The pipe shall be laid on a foundation to the grades and alignment as shown on the drawings. The pipe shall be supported in such a manner that does not damage the pipe or pipe joints and such that the pipe is at the grade and alignment shown on the drawings. Each section of pipe shall rest upon the pipe bed for its full length with recesses excavated or formed to accommodate the joints. Any pipe which has its grade or joint disturbed after laying shall be taken up and relaid. Any section of pipe already laid which is found to be defective or damaged shall be taken up and relaid or replaced as directed by the Contracting Officer, without

additional cost to the Government.

3.5.2 Pipe Joints. Joints between sections of reinforced concrete pipe and between the pipe and the flared end section shall be in accordance with ASTM C 361. Gaskets shall not have more than one factory-fabricated splice. Gaskets shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected at all times from the sun, blowing dust, and other deleterious agents. Gaskets shall be inspected before installing the pipe; any loose or improperly affixed gaskets shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint, the gasket becomes loose and can be seen through the exterior joint recess when the joint is pulled up to within one inch of closure, the pipe shall be removed and the joint remade.

3.5.3 Culvert Pipe. During installation, the pipe shall be handled with care. After all joining of sections has been accomplished, backfill shall be placed as specified.

3.6 TESTING. Air test of the completed installation will not be required. Visual inspection of the work in progress and shortly after completion will be the acknowledgement of field approval. The final acceptance of the work will be the responsibility of the Contracting Officer.

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SECTION 03300
CONCRETE

PART 1 - GENERAL

1.1 SCOPE. The work covered by this section consists of furnishing all material and equipment, and performing all labor for the manufacture, transporting, placing, finishing, and curing of concrete and concrete joints in these specifications. The extent of concrete work is as shown on the drawings.

1.2 QUALITY CONTROL.

1.2.1 General. The Contractor shall establish and maintain quality control for all operations to assure compliance with contract requirements and maintain records of quality control for all construction operations, including but not limited to the following:

- (a) Forms (line and grade, mortar tightness, bracing, and embedded items).
- (b) Placement (lifts, vibrating).
- (c) Finishing.
- (d) Curing.
- (e) Aggregate Gradations.
- (f) Reinforcing.
- (g) Concrete mixture.
- (h) Slump Testing.
- (i) Air Content Testing.
- (j) Concrete Cylinders.
- (k) The laboratory performing the tests shall conform to ASTM E 329 and perform tests in accordance with applicable requirements of ASTM Standards.

1.2.2 Reporting. A copy of these records and tests, as well as the records of corrective action taken, shall be furnished to the Government daily.

1.3 REFERENCES. All referenced publications shall be the most current version, edition, standard, latest revision, or reapproval unless otherwise stated. The publications and standards listed below will be referred to only by the basic designation, and shall form a part of this specification to the extent indicated by the references thereto:

1.3.1 American Society for Testing and Materials (ASTM).

- A 615/A 615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- C 31 Making and Curing Concrete Test Specimens in the Field
- C 33 Concrete Aggregates
- C 39 Compressive Strength of Cylindrical Concrete Specimens
- C 94 Ready-Mixed Concrete
- C 143 Slump of Hydraulic Cement Concrete
- C 150 Portland Cement

C 171	Sheet Materials for Curing Concrete
C 172	Sampling Freshly Mixed Concrete
C 231	Air Content of Freshly Mixed Concrete by the Pressure Method
C 260	Air-Entraining Admixtures for Concrete
C 309	Liquid Membrane-Forming Compounds for Curing Concrete
C 494	Chemical Admixtures for Concrete
C 920	Elastometric Joint Sealants
D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
E 329	Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.3.2 American Concrete Institute (ACI).

ACI 318 Building Code Requirements for Structural Concrete

1.3.3 American Association of State Highway and Transportation Officials (AASHTO).

AASHTO M 182 Burlap Made From Jute or Kenaf

1.4 EVALUATION AND ACCEPTANCE. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive individual strength tests (average of two cylinders) equal or exceed the required specified strength f'_c and no individual strength test (average of two cylinders) falls below the specified strength f'_c by more than 500 pounds per square inch.

1.5 SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01300 SUBMITTAL PROCEDURES.

1.5.1 Data. Materials; FIO. Submit manufacturer's literature showing that the following materials conform to the specified requirements:

- (a) Air-entraining agent
- (b) Water reducing admixture
- (c) Curing materials
- (d) Reinforcing steel (Mill Certificates)
- (e) Forming accessories
- (f) Joint material
- (g) Non-shrink grout

1.5.2 Statements. Concrete Mix Proportions; GA. The proportions of the concrete materials in the mix shall be the responsibility of the Contractor. Prior to placement of concrete, the Contractor shall submit mixture proportions to be used during construction, which will produce concrete of the qualities required along with the source of concrete. Mixture

proportions shall include dry weights of cement, saturated surface-dry weights of fine and coarse aggregates, and quantities, type and name of admixtures and total quantity of water per cubic yard of concrete. Also satisfactory evidence shall be given that the materials to be used and the proportions selected will produce concrete of the quality specified. All materials included in the mixture proportions shall be of the same type and from the same source as will be used on the project.

1.5.3 Certificates. Cementitious and Aggregate Materials; GA. Submit manufacturer's certificate of compliance for cementitious and aggregate materials.

PART 2 - PRODUCTS

2.1 MATERIALS.

2.1.1 Cement. Cement shall be portland cement, conforming to ASTM C 150, Type I or Type II.

2.1.2 Aggregates. Aggregates shall comply with ASTM C 33.

2.1.3 Admixtures. Admixtures to be used, when required or approved, shall comply with the appropriate specification listed below:

2.1.3.1 Air-Entraining Admixture. ASTM C 260.

2.1.3.2 Water-Reducing Admixtures. ASTM C 494, Type A, B or D.

2.1.4 Curing Materials.

2.1.4.1 Burlap. AASHTO M 182.

2.1.4.2 Impervious Sheets. ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

2.1.4.3 Membrane-Forming Compounds. ASTM C 309, Type 1-D, Class A or Class B. Curing compound shall be compatible with subsequent surface finishes indicated on the drawings or specified herein. Curing compounds shall not be applied to concrete surfaces to receive seamless epoxy flooring without written approval of epoxy flooring manufacturer.

2.1.5 Water. Water for mixing shall be fresh, potable, and free from injurious amounts of oil, acid, salt, alkali, organic matter or other deleterious substances.

2.1.6 Concrete Quality. Specified compressive strength f'_c shall be 4000 pounds per square inch at 28 days. Concrete shall have a minimum cement content of 564 pounds per cubic yard and a maximum water cement ratio by weight of 0.45. The concrete shall not contain fly ash. The maximum nominal size coarse aggregate shall be 1-inch. The air content shall be 6.0 ± 1.5 percent. The slump shall not vary more than $\pm 1\frac{1}{2}$ inch from $3\frac{1}{2}$ inches.

2.1.7 Form Material. Material with sufficient ability to withstand pressure of placed concrete without bow or deflection.

2.1.8 Reinforcing Materials.

2.1.8.1 Reinforcing Steel. Reinforcing steel shall be deformed bars conforming to ASTM A 615, grade 60 and sizes as indicated on the drawings.

2.1.8.2 Wire Ties. Wire ties shall be 16-gauge or heavier black annealed steel wire.

2.1.9 Premolded Joint Filler. Premolded joint filler shall conform to ASTM D 1752, Type I sponge rubber.

2.1.10 Joint Sealant. Field Molded Sealants and Primer. Field molded sealants and primer shall conform to ASTM C 920, Type M, Grade P, Class 25, use T for horizontal joints, and Type M, Grade NS, Class 25, use NT for vertical joints. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, nonshrink, nonreactive with sealant, and nonabsorptive material type such as extruded butyl or polychloroprene foam rubber.

2.1.11 Non-shrink Grout. Non-shrink grout conforming to ASTM C1107, requiring only mixing with water at the worksite, shall be used where shown on the drawings. The mixing, placing, and curing shall be as recommended by the manufacturer.

PART 3 - EXECUTION

3.1 PRODUCTION OF CONCRETE. Ready-mixed concrete shall conform to ASTM C 94, except as otherwise specified.

3.2 PREPARATION FOR PLACING. Formwork shall be complete and mortar tight. Ramps and walkways, as necessary, shall be constructed to allow safe and expeditious access for concrete and workmen. Snow, ice, standing or flowing water, loose particles, debris and foreign matter shall have been removed. Select granular fill and subgrade under slabs shall be satisfactorily compacted. Reinforcement shall be secured in place; joints, anchors and other embedded items shall have been positioned. All equipment needed to place and consolidate the concrete shall be at the placement site and in good operating condition. Spare vibrators shall be available. The entire preparation shall be accepted by the Government prior to placing.

3.2.1 Embedded Items. Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings. Embedded items shall be free of oil and other foreign matter such as loose coatings of rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed.

3.3 PLACING.

3.3.1 General. Concrete placement shall not be permitted when weather conditions prevent proper placement and consolidation. Concrete shall be worked into the corners and angles of the forms and around all reinforcement and embedded items without permitting the material to segregate. Concrete shall be placed within 45 minutes after water has been added, unless otherwise approved by the Contracting Officer. It shall be placed on a clean, damp surface free from water, ice, frost, mud, debris or objectionable coatings. Surfaces against which concrete is to be placed shall have a temperature of not less than 50 degrees F. Concrete shall be consolidated with the aid of mechanical vibrating equipment supplemented by hand spading and tamping. Vibrating equipment shall be of the internal type and shall at all times be adequate to properly consolidate all concrete. A stand-by power unit will be required on site if vibrators are operated by an external power source. All concrete placing equipment and methods shall be subject to approval.

3.3.1.1 Slabs on Grade. The subgrade shall be brought to an even plane and compacted thoroughly to obtain a firm surface with material as specified in SECTION 02222 - EMBANKMENT. Concrete shall be deposited to the required thickness, and finished as specified herein.

3.3.2 Placing Temperature. Concrete, when deposited in the forms during cold weather, shall have a temperature of not less than 50 degrees F nor more than 70 degrees F. Heating of the mixing water or aggregates will not be permitted until the temperature of the concrete has decreased to 55 degrees F. The materials shall be free from ice, snow, and frozen lumps before entering the mixer. All methods and equipment shall be subject to approval. All concrete placed during warm weather shall be delivered to the forms at the coolest temperature, which is practical to produce under current conditions but not above 90 degrees F.

3.3.3 Formwork. Construct so that concrete members and structures are of correct size, shape, alignment, elevation and position. Provide openings in formwork to accommodate work of other trades. Accurately place and securely support items built into forms. Forms for exposed surfaces shall be coated with nonstaining form oil, which shall be applied shortly before concrete is placed. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather, oil shall be used. Forms shall not be removed without approval. All form removals shall be accomplished in such a manner as to prevent injury to the concrete. Forms shall not be removed before the expiration of the minimum of 24 hours after completion of the concrete placement except where otherwise specifically authorized by the Contracting Officer. When conditions on the work are such as to justify the requirement, forms will be required to remain in place for longer periods.

3.3.4 Furnishing and Placing Steel Reinforcement.

3.3.4.1 General. The Contractor shall furnish, cut, bend, and place all steel reinforcement including rods and fabric, as indicated on the drawings. All reinforcement shall be, when surrounding concrete is placed, free from loose flaky rust and scale, and free from oil, grease, or other coating, which might destroy or reduce its bond with the concrete.

3.3.4.2 Cutting and Bending. Steel reinforcement shall be shop bent. All bending shall be in accordance with standard approved practice and by approved machine methods.

3.3.4.3 Concrete Cover. The cover for reinforcement shall be as indicated on the drawings.

3.3.4.4 Splicing. All splices in reinforcement shall be in accordance with the requirements of ACI 318, unless otherwise shown on the drawings.

3.3.4.5 Supports. All reinforcement including welded wire fabric shall be secured in place by the use of metal or concrete supports, spacers or ties, as approved.

3.4 JOINTS.

3.4.1 General. All joints in the concrete slabs shall conform to the locations, designs, and details shown on the drawings, and as specified herein. The required materials shall be furnished and placed by the Contractor. Sufficient fastenings shall be used to ensure that joint assemblies and materials remain in position during the entire period of concrete placing, striking off, vibrating and finishing.

3.4.2 Expansion Joints. Provide premolded joint filler at expansion joints. The top edge of the joint material shall be protected, while the concrete is being placed, by a metal channel cap of at least 10-gage material having flanges at least 1-1/2 inches deep. The installing device may be designed with this cap self-contained. For expansion joints to receive sealant, top of joint filler shall be not less than 1/2-inch or more than 1-inch below finished surface for joint sealer.

3.4.3 Control Joints. Control joints for the slabs shall be sawn 4 to 12 hours following concrete placement and shall be of the size and dimensions indicated on the drawings. Joints shall be true and to the alignment indicated on the drawing.

3.4.4 Construction Joints. So as not to limit the Contractor's placing of the slabs, locations of construction joints are not indicated. However, when placement of the entire slab is not performed in a single continuous operation, construction joints shall be provided with details as shown on the drawings. Locations of construction joints in slabs shall coincide with slab control joint locations indicated.

3.4.5 Joint Sealant. Where joint sealant is indicated on the drawings, joints shall be primed and installation of sealant shall be in accordance with the manufacturer's recommendations.

3.5 FINISHING.

3.5.1 General. No finishing nor repairs shall be accomplished when either the concrete or the ambient temperature is below 50 degrees F.

3.5.2 Finishing Unformed Surfaces. All unformed surfaces that are not to be covered by additional concrete or backfill shall be float finished to elevations shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown on the drawing and left as a true and regular surface. Exterior surfaces shall be sloped for drainage unless otherwise shown on the drawings. Joints shall be carefully made with a jointing tool. Unformed surfaces shall be finished to a tolerance of 1/8 inch for a trowel finish and 1/4 inch for a float finish as determined by a 10-foot straightedge placed on surfaces shown on the plans to be level, or having a constant slope. Finishing shall not be performed while there is excess moisture or bleeding water on the surface.

3.5.2.1 Float Finish. Surfaces to be float finished shall be screeded and darried or bullfloated to eliminate the ridges and fill in the voids left by the screed. In addition, the darby or bullfloat shall fill all surface voids and only slightly embed the coarse aggregate. When the water sheen disappears and the concrete will support a man, floating should be completed. Floating should embed large aggregates just beneath the surface, remove slight imperfections, humps and voids, to produce a plane surface and compact the concrete and consolidate mortar at the surface.

3.5.2.2 Broom Finish. A light (soft) broom finish shall be applied to the surface of the slabs. Such concrete surfaces shall first be finished with a float finish. Finished surfaces shall be protected from damage during the construction period.

3.6 CURING AND PROTECTION. Beginning immediately after placement, and continuing for at least 7 days, unless indicated otherwise, all concrete shall be cured and protected from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage and exposure to rain or

flowing water. Areas of concrete slabs to receive seamless epoxy flooring shall be cured and protected for a minimum of 21 days. All materials and equipment needed for adequate curing and protection shall be available and at the site of the placement prior to start of concrete placement. Preservation of moisture for concrete surfaces not in contact with forms shall be accomplished by one of the following methods:

- (1) Ponding or continuous sprinkling.
- (2) Application of absorptive mats or fabrics kept continuously wet.
- (3) Application of sand kept continuously wet.
- (4) Application of membrane forming curing compound shall be applied in accordance with manufacturer's instructions.

3.7 PROTECTION. The Contractor shall protect the concrete from damage until acceptance of work. No material shall be placed on concrete slabs for a minimum of 14 days, or until the specified strength as required in paragraph 2.1.6 is met. When construction traffic is permitted, maintain concrete as clean as possible by removing surface stains and spillage of materials as they occur. Sweep concrete and wash free of stains, discoloration, dirt and other foreign material just prior to final inspection.

3.8 TESTS AND INSPECTIONS

3.8.1 General. The individuals who sample and test concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.8.2 Inspection Details and Frequency of Testing.

3.8.2.1 Preparations for Placing. Foundation or construction joints, forms, and embedded items shall be inspected in sufficient time prior to each concrete placement by the Contractor to certify that it is ready to receive concrete.

3.8.2.2 Air Content. Air content shall be checked at least once during each shift that concrete is placed. Samples shall be obtained in accordance with ASTM C172 and tested in accordance with ASTM C231.

3.8.2.3 Slump. Slump shall be checked at least once during each shift that concrete is produced. Samples shall be obtained in accordance with ASTM C172 and tested in accordance with ASTM C143.

3.8.2.4 Strength. The strength of the concrete shall be checked at least once during each shift that concrete is produced. A total of three test specimens, one tested at seven days and two tested at twenty-eight days, shall be obtained in accordance with ASTM C172 and test specimens made in accordance with ASTM C31 and tested in accordance with ASTM C39. The Contractor shall make additional test specimens as needed for testing at other times as required to verify strength for protection indicated in paragraph 3.7.

3.8.2.5 Consolidation and Protection. The contractor shall ensure that the concrete is properly consolidated, finished, protected, and cured.

3.8.3 Action Required.

3.8.3.1 Placing. The placing foreman shall not permit placing to begin until he has verified that an adequate number of acceptable vibrators, which are in working order and have competent operators, are available. Placing shall not be continued if any pile is inadequately consolidated.

3.8.3.2 Air Content. Whenever a test result is outside the specification limits (between 4.5 and 7.5 percent), the concrete shall not be delivered to the forms and an adjustment shall be made to the dosage of the air-entrained mixture.

3.8.3.3 Slump. Whenever a test result is outside the specification limits (between 2 and 5 inches), the concrete shall not be delivered to the forms and an adjustment shall be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the water-cement ratio does not exceed that specified in the submitted concrete mixture proportion.

3.8.3.4 Strength. The acceptance shall be in accordance with paragraph 03300-1.4

3.8.4 Reports. The results of all tests and inspections conducted at the project site shall be reported in writing daily.

-- END OF SECTION 03300 --